

***Regulus bulgaricus* sp. n. - the first fossil Kinglet
(Aves: Sylviidae) from the Late Pliocene of
Varshets, Western Bulgaria**

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Introduction

The Middle Villafranchian (MN zone 17) site in the vicinity of the town of Varshets, discovered in 1987, contains over 110 vertebrate species, among which 7 species of amphibians and reptiles, 35 species of small mammals, 17 species of large mammals (SPASSOV, 1998) and at least 51 species of birds (BOEV, 1995a; 1995b). In this way, it reveals the richest Villafranchian avifauna of Europe (BOEV, 1996) and one of the richest Tertiary vertebrate faunas in general (SPASSOV, 1998).

Genus *Regulus* Linnaeus, 1758 in the recent avifauna

Genus *Regulus* consists of 5 recent species. Two of them (*R. regulus* and *R. ignicapillus*) are spread in the Palearctic region and the other two (*R. calendula* Linnaeus, 1766 and *R. satrapa* Lichtenstein, 1823) breed in the Nearctic region, while the fifth species (*R. goodfellowi* Ogilvie-Grant) is an endemic for Taiwan (HOWARD & MOORE, 1980). Thus, the overall range of *Regulus* may be defined as Holarctic.

**Ecobiogeographical characteristics of the Palearctic species of genus
*Regulus***

Regulus regulus (Linnaeus, 1758) is a resident and migratory nesting and wintering species in the Boreal and Temperate zones of the region. It is a typical inhabitant of the coniferous forests. Sometimes, but very seldom, it visits the

Fagus and *Quercus* forests. It is chiefly a mountain species and often reaches the tree-limit in the mountains (HARRISON, 1982). Its breeding range is confined by the 13°C and 24°C July isotherms. Strictly arboreal in the nesting season. Prefers the forests of *Picea abies*, *Abies alba*, *Pinus mugo*, *P. sylvestris*, *Larix*, etc. (CRAMP, 1992).

Regulus ignicapillus (Temminck, 1820) is also a resident and migratory nesting and wintering species in the Boreal and Temperate zones. Found predominantly in the lowland deciduous forests and the evergreen forest in the Mediterranean. It also visits the mixed and coniferous forests (HARRISON, 1982). Inhabits the undergrowth up to 3 m. Its breeding range is limited by the 14-16°C and 24°C July isotherms. A certain expansion of its range was established in 19-th - 20th century in W Europe (CRAMP, 1992).

Fossil record of genus *Regulus*

No fossil taxa of that genus have been described so far (BRODKORB, 1978; OLSON, 1985; MLIKOVSKY, 1996; BOCHENSKI, 1997). BRODKORB (1978) has summarized the data of the Pleistocene records of *R. regulus* in England, Poland and France. The species was reported from the Magdalenian and Neolithic in the Grotte du Rond-du-Barry in France (MOURER-CHAUVIRÉ, 1974; 1975). TYRBERG (1998) lists the Late Pleistocene sites of *R. regulus* in the former Czechoslovakia, Israel and Poland, an Early Pleistocene site of *R. ignicapillus* from Spain and a Middle Pleistocene site of *Regulus* sp. and three Late Pleistocene sites of *Regulus* sp. from Switzerland, Hungary and Israel.



Regulus bulgaricus sp. n.

Holotype: a complete left ulna (Fig. 1). Collections of the Fossil and Recent Birds Department of the National Museum of Natural History, Bulgarian Academy of Sciences, No NMNHS - 24. Collected on 20 September 1991 by Z. Boev.

Fig. 1. *Regulus bulgaricus* sp. n., ulna sin. ad. (holotype, NMNHS 24): medial view (left), and lateral view (Photograph: Boris Andreev)

Paratypes: No additional material has been collected and no paratypes have been specified.

Locality: A ponor in a rocky hill, 6 km NNE of Varshets (43° 13' N, 23° 17' E).

Horizon: Unconsolidated, unstratified sediments accumulated in the filling of clay a terra-rossa. The fossil bones are broken, sometimes making a kind of bone breccia.

Table 1

Measurements of ulna sin. in fossil and recent *Regulus* (ref. to Fig. 2)

Species	a	b	c	d	e	f
Fossil						
<i>Regulus bulgaricus</i> sp.n. NMNHS 24	13,3	2,2	1,9	1,5	0,8	0,9
Recent						
<i>Regulus regulus</i> UCBL 391-1	13,0	2,0	1,9	1,5	0,8	0,9
<i>Regulus regulus</i> UCBL 391-2	13,1	1,9	1,8	1,4	0,8	0,9
<i>Regulus regulus</i> UCBL 391-3	13,3	2,1	1,8	1,5	0,8	0,9
<i>Regulus regulus</i> UCBL 391-4	12,9	2,1	1,8	1,5	0,8	1,0
<i>Regulus regulus</i> UCBL 391-5	12,9	2,0	1,8	1,5	0,8	0,9
<i>Regulus regulus</i> NMNHS 1/1992	13,2	1,9	1,8	1,5	0,8	0,9
<i>Regulus regulus</i> NMNHS 2/1992	12,6	1,8	1,8	1,5	0,8	0,8
<i>Regulus ignicapillus</i> UCBL 392-1	13,0	1,9	1,8	1,5	0,8	0,9
<i>Sylvia communis</i> NMNHS 2/1987	18,0	2,8	2,7	2,2	1,2	1,3
<i>Sylvia atricapilla</i> NMNHS 4/1991	19,0	2,9	2,6	2,1	1,2	1,2
<i>Sylvia melanocephala</i> NMNHS 2/1982	18,7	2,9	2,8	2,1	1,3	1,5
<i>Sylvia nisoria</i> NMNHS 1/1988	22,0	3,4	3,1	2,5	1,4	1,5
<i>Hippolais pallida</i> NMNHS 1/1982	16,6	2,2	2,4	2,0	1,0	1,4
<i>Troglodytes troglodytes</i> NMNHS 3/1994	13,2	2,2	1,9	1,6	0,8	0,9
<i>Troglodytes troglodytes</i> NMNHS 4/1997	13,2	2,1	1,9	1,5	0,9	0,9

Chronostratigraphy: Middle Villafranchian. The associated fauna of mammals (SPASSOV, 1995; V. POPOV - pers. comm.) attributes the site to the MN 17 zone according to the stratigraphical system of MEIN (1990).

Etymology: The name „*bulgaricus*“ is given after Bulgaria, the name of the country, where the find of that species originates from.

Measurements: see Table 1, Fig. 2.

Diagnosis: A fossil species of *g. Regulus*, differing by the thicker base and longer olecranon ulnae, the bigger cotyla dorsalis, the less protruding papilae remigales

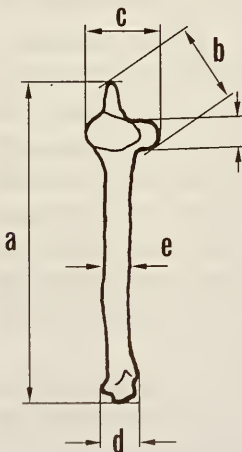


Fig. 2. The manner of measurings of the ulna in Sylviidae: a - total length, b - diagonal of proximal epiphysis between olecranon and cotyla dorsalis, c - width of proximal epiphysis, d - width of distal epiphysis, e - thickness of diaphysis in the middle (Drawing: Vera Hristova)

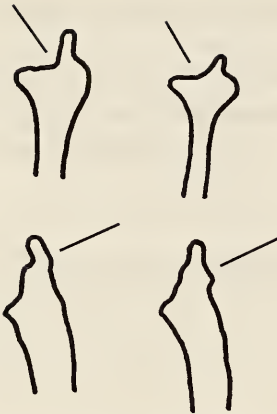


Fig. 3. Comparison of the contour of the left proximal ulna in *Regulus bulgaricus* sp. n. (left) and *R. regulus* (right): posterior view (top) and dorsal view (bottom)

the fam. Sylviidae and, more exactly, to the g. *Regulus*. The find N 24 differs from *R. regulus* by the thicker base and the longer olecranon ulnae (Fig. 4), the bigger cotyla dorsalis (measurement „c“ on Fig. 2; Fig. 3) and the smaller (less protruding) papilae remigales caudales. It differs from *R. ignicapillus* by the narrower proximal part of the diaphysis, the shorter olecranon ulnae and the smaller



Fig. 4. Ulna sin. in *Regulus bulgaricus* sp. n. (left) and *R. regulus* (right) (Photograph: Boris Andreev)

caudales, the more massive proximal part of diaphysis and the smaller tuberculum retinaculi.

Comparison: The specimen N 24 has the specific appearance of a small passeriform bird. It differs from all genera of Turdidae, Emberizidae, Fringillidae, Muscicapidae, Cinclidae, Bombycillidae, Oriolidae, Laniidae, Corvidae, Passeridae, and Sturnidae by its smaller size. Differences from Hirundinidae, Timaliidae, Paridae, Sittidae, Tichodromadidae, Certhiidae, Remizidae are clearly seen both in its smaller size, and morphology (a very thin and gracile diaphysis, and slightly banded, but not right and relatively small epiphyses. Although of similar size (Table 1), the specimen from Varshets clearly differs from *Troglodytes troglodytes* Linnaeus, 1758 (fam. Troglodytidae) in the clear and round outlining of the cotyla ventralis and the larger base of the olecranon. The shape and the relief of the proximal and distal articular surfaces suggest that this taxon belongs to

the fam. Sylviidae and, more exactly, to the g. *Regulus*. The find N 24 differs from *R. regulus* by the thicker base and the longer olecranon ulnae (Fig. 4), the bigger cotyla dorsalis (measurement „c“ on Fig. 2; Fig. 3) and the smaller (less protruding) papilae remigales caudales. It differs from *R. ignicapillus* by the narrower proximal part of the diaphysis, the shorter olecranon ulnae and the smaller tuberculum retinaculi. These features are rather conservative and are represented in all the compared specimens of the genus, listed in Table 1. We have not comparative material of *R. goodfellowi* at our disposal, but we can exclude the taxonomical identity with our fossil specimen on the ground of *R. goodfellowi* forming a superspecies with *R. regulus* (CRAMP, 1992). As seen from the measurements, cited by the same author, the length of the wing of *R. calendula* is 7,8 (in females) to 9,6 (in males) per cent larger than that of *R. regulus*. The metrical differences between *R. calendula* and *R. ignicapillus* are much greater - 11,8 % in males and 12,5 % in females. This somatométrical feature possibly reflects the analogous correlation between the total length of their ulnae (measurement „a“).

Collections acronyms: NMNHS - National Museum of Natural History - Sofia; UCBL - Centre des Sciences de la Terre at the Claude Bernard University - Lyon 1.

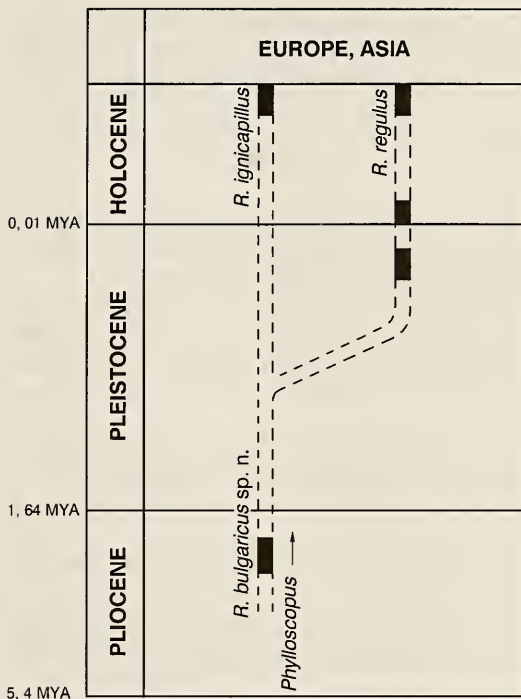


Fig. 5. Tentative phylogeny of the Western Palearctic kinglets (g. *Regulus*)

relates better to our data for the presence of open light savanna type forests in the vicinity of the site in the Middle Villafranchian (BOEV, 1995a). According to BLONDEL (1997), the Northern coniferous belt in the Holarctic appeared as a vegetation zone in the mountains of Eastern Siberia, is a definitely new event, unknown in the whole pre-Pleistocene history of the vegetation in the Northern Hemisphere. Thus, its avifauna is also younger and of a modern origin. This fact makes possible the acceptance of *R. bulgaricus* sp. n. as a more probable ancestor of *R. ignicapillus*, or at least, as a stage of its evolutionary lineage. *R. regulus* is more „boreal“, inhabiting chiefly the coniferous massifs of the Temperate zone at present, a habitat that had not obviously been in existence around the site before the end of Pliocene. Hence, *R. regulus* can be defined as the younger species of the Palearctic kinglets. It can be ascertained that the fossil record of *R. regulus* started from the Late Pleistocene and that the species differentiation must have occurred not later than the Middle Pleistocene. A scheme of the phylogeny of the Western Palearctic kinglets is proposed in Fig. 5.

Comparative material examined: Fossils from Varshets were compared with skeletons of the following species: Collections of the UCBL: *R. regulus*: 391-1, 391-2, 392-3, 391-4, 391-5; *R. ignicapillus*: 392-1.; Collections of the NMNHS: *Regulus regulus* 1/1992; 2/1992; *Sylvia communis* 2/1987; *Sylvia atricapilla* 4/1991; *Sylvia melanocephala* 2/1982; *Sylvia nisoria* 1/1988; *Hippolais pallida* 1/1982; 2/1982; *Troglodytes troglodytes* 3/1994; 4/1997.

Discussion

As it has been seen, *Regulus bulgaricus* sp. n. is the only fossil species of the genus found up to now. *R. ignicapillus* inhabits chiefly lowland deciduous forests which

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***Regulus bulgaricus* sp. n. - първото фосилно кралче (Aves: Sylviidae) от късния плиоцен на Вършец**

Златозар БОЕВ

(Р е з ю м е)

Представено е морфологичното сравнение и описание на цяла лява лакътна кост от неизвестен досега фосилен вид кралче (*Regulus*), произлизащ от средновеоценовото находище на фосилна фауна и флора край гр. Вършец (MN зона 17).

Диагноза: Фосилен вид от рода *Regulus*, отличаващ се с по-дебелата основа и по-дългия olecranon ulnae, по-голямата cotyla dorsalis, по-слабо изпъкналия tuberculum retinaculi, по-слабо изпъкналите papillae remigales caudales и по-масивната проксимална част от диафизата.

Обща дължина на костта - 13,3 mm.

Regulus bulgaricus sp. n. е първото фосилно кралче. Петте рецентни вида на рода са строго арбореални. *R. ignicapillus* населява предимно низинни листопадни гори, което по-добре съответства на данните за наличието на саванни гори и редколесия в околността на находището. Имайки предвид и факта, че иглолистният пояс в Холарктика е със съвсем млада (холоценска) възраст, както и населяващата го авифауна, се изказва предположението, че описаният вид е възможен предшественик на *R. ignicapillus* или поне лежи на неговата еволюционна линия. *R. regulus* е по-“бореален“ вид и понастоящем обитава главно иглолистните масиви в умерения пояс, каквито очевидно не са съществували в края на плиоцена около находището. Затова *R. regulus* е считан за по-младия вид от двете западнопалеарктични кралчета. Предложена е схема за тяхната филогения.